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**Using Public- Private Partnerships and Energy Savings
Contracts to Fund DoD Mobile Assets**

30 September 2006

by

Dr. Joseph G. San Miguel, Professor, and

Donald E. Summers, Lecturer

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**Naval Postgraduate School
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Leonard A. Ferrari, Ph.D.
Provost

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The report was prepared by:

Dr. Joseph G. San Miguel, Professor
Graduate School of Business & Public Policy

Donald E. Summers, Lecturer
Graduate School of Business & Public Policy

Reviewed by:

Robert N. Beck
Dean, Graduate School of Business & Public Policy

Released by:

Dan C. Boger, Ph.D.
Acting Dean of Research

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Abstract

The Department of Defense (DoD) has engaged in numerous Public-Private Partnership (PPP) ventures such as outsourcing of services and privatization of military housing. In the past, the activities considered for PPPs have been primarily administrative and support functions. This research explores the possibility of expanding the use of PPPs to enhance the DoD combat and combat-support functions. First, to better understand how PPPs function (the partnership relationships and financing arrangements), we examine Hannon Armstrong's "fee for service contract" solution to the lack of appropriated funds for establishing a vital fiber-optic link near the Arctic Circle. Next, we explore the history of Energy Savings Performance Contracts (ESPCs) and their potential application to re-engining the Air Force's B-52H through PPPs. Historically, this program has only been used for fixed assets, not mobile assets like engines. There is little debate over the success of ESPC contracts in reducing energy consumption, but their use in DoD mobile assets is new. Finally, we conclude that applying ESPCs to mobile assets has the potential to reduce energy consumption, save millions of dollars and increase combat efficiency.

Keywords: Public Private Partnership, PPP, Energy Savings Performance Contracts (ESPCs) for mobile assets, Privatization, Outsourcing, B-52H re-engining program, Alternative Forms of Financing Defense Requirements, Fee for Service Contracts

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About the Authors

Joseph San Miguel, PhD, CPA, is Professor of Financial Management, Graduate School of Business & Public Policy, Naval Postgraduate School. He received his PhD at the University of Texas at Austin. He has taught at NYU, Harvard, Stanford, and Dartmouth and consulted and taught executive programs for numerous companies. His interests are strategic resource management, strategic control, and corporate financial reporting.

Joe San Miguel
Professor
Graduate School of Business and Public Policy
Naval Postgraduate School
Monterey, CA 93943-5197
Tel: (831) 656-2187
E-mail: jsanmiguel@nps.edu

Don Summers, LtCol, USMC (Ret.), CMA, is Lecturer in Financial Management, Graduate School of Business & Public Policy, Naval Postgraduate School. He received an MS from the Naval Postgraduate School. Before retiring from the USMC, he was Program Budget Coordinator for the Chief Financial Officer, Headquarters Marine Corps. He has consulted for numerous companies and has been employed as a financial analyst. His interests are financial and managerial accounting, federal budgeting and armed forces comptrollership.

Don Summers
Lecturer
Graduate School of Business and Public Policy
Naval Postgraduate School
Monterey, CA 93943-5197
Tel: (831) 656-3632
E-mail: desummer@nps.edu

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Executive Summary

This research explores the efficacy of Public-Private Partnerships (PPP). Our initial inquiries indicate that this is an area of major potential significance to the DoD. We will examine innovative uses of public-private partnerships through two case studies, which were supported by Hannon Armstrong, Inc., a financial services firm that specializes in federal contract financing.

Resource limitations may result in the government choosing a solution to a problem that may not be in the best interest of all the parties involved. Through partnerships with the private sector, the federal government enhances its capabilities by accessing a larger pool of funds. The private sector also gains from these partnerships with increased access and involvement in providing services to the government.

In the first case study, Hannon-Armstrong's "fee for service contract" project in the Arctic Circle will be examined. This is a prime example of how the public and private sector can collaborate to achieve a common goal. Through third party financing, Hannon-Armstrong enabled a project to lay a vital fiber-optic cable link near the Arctic Circle that benefited the Department of Defense, the government of Norway, and other federal agencies. Application of the lessons learned from the fiber-optic link project can be translated to the second case study, Energy Savings Performance Contracts (ESPCs) and mobile assets.

The second case study analyses the historical, legislative, and fiscal aspects of ESPCs for mobile assets. ESPCs are just one type of public-private partnership that has been used successfully by the federal government to achieve its energy-reduction goals. Recognizing that the government is one of the largest consumers of energy in the country, to reduce energy consumption throughout the government, the Executive branch developed energy-reduction goals, and Congress developed Energy Savings Performance Contracts to help achieve these goals. These contracts rely on private financing to modernize existing facilities and infrastructure

with lower-energy-consuming products and components. In this unique arrangement, the contractor is paid from the resultant energy savings over a period of time (usually 25 years). When the contract period ends, the government retains all additional savings.

Because ESPCs have been highly successful throughout the government, Congress extended this program to 2016. ESPCs have been the key to helping the federal government reduce its energy consumption in existing facilities.

Although, ESPCs have not been used for mobile assets, this use has been discussed and proposed in Congress with no action. Fuels used to operate aircraft, ships, tanks and other vehicles make up 60 percent of the Department of Defense's energy consumption. A significant savings in taxpayer dollars can be realized through reduced energy consumption in the federal government's mobile asset fleet. ESPCs place performance risk in the hands of the contractor. If savings from modernization do not result, the contractor is responsible for making up for any lost savings. The government continues to own, operate, and maintain the asset. Therefore, risk transfer operates as a form of insurance policy: if certain aspects of the project go wrong, the private-sector firm assumes the cost. By placing the risk on the contractor, ESPCs ensure that contractors engage projects that generate savings.

The B-52H Bomber's aircraft is a mobile asset that the Air Force could modify and modernize by utilizing ESPCs to replace its engines. New B-52H engines will decrease fuel consumption and pollution while increasing aircraft range and performance. The problem is that originally, not enough funds were appropriated to pay for these modifications. Appropriated dollars are being used for other higher-priority requirements. Therefore, an ESPC is one potential solution to these types of modernization problems. By allowing third-party financing, the government is able to modernize the B-52H, reduce energy consumption, and save taxpayer dollars.

Proponents of ESPCs assert that by utilizing ESPCs, the government will realize savings and energy reductions that would otherwise be lost given the status

quo. The cost of doing nothing is the worst scenario, the proponents argue. Critics contend that ESPCs by-pass the appropriations and acquisition process and take power away from Congress. They argue that Congress should retain its oversight and deny ESPCs for mobile assets. Our research concludes that ESPCs are applicable to mobile assets, and we recommend that Congress authorize a pilot DoD program to use the ESPC program for mobile assets.

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Introduction

I have determined that the current DoD Directive 5000.1, “The Defense Acquisition System,” DoD Instruction 5000.2, “The Operation of the Defense Acquisition System,” and DoD 5000.2-R, “Mandatory Procedures for Major Defense Acquisition Programs (MDAPS) and Major Automated Information Systems (MAIS) Acquisition Programs,” require revision to create an acquisition policy that fosters efficiency, flexibility, creativity, and innovation. Therefore, by separate memorandum, I have cancelled those documents immediately.

—Deputy Secretary of Defense Paul Wolfowitz,
Policy Memorandum, Cancellation of DoD 5000 Defense
Acquisition Policy Documents, October 30, 2002.

Clearly, there is heavy pressure in Washington, DC, to limit the Department of Defense (DoD) acquisition budget. There is also a steady stream of “critically important” new weapon systems under development across all branches of the military. The result will necessarily be that many “highly desirable,” if not “critical,” programs are cut back or even eliminated. At stake is the maintenance and improvement of US national defense and victory of the War on Global Terror.

One way to ease this potential impairment of National Security is to fund DoD investments outside the normal Congressional appropriations process. One term for such alternative financing mechanisms is “Public-Private Partnerships” (PPPs). PPPs have generated substantial benefits for the public sector by providing greater flexibility in financing, encouraging innovation, reducing risks, and saving time and financial resources. Acquiring combat capability through PPPs is an innovative approach that has the potential to foster the efficiency, flexibility, and creativity that former Secretary of Defense Paul Wolfowitz sought.

History of Public-private Partnerships (PPPS)

In order to understand the context of the two case studies, it is important to first understand the role and background of public-private partnerships (PPPs).

PPPs establish a cooperative partnership between the public and private sectors in order to pool resources towards a common goal. Using PPPs, a public agency can access the private sector's technical expertise, knowledge, insight, and capital to achieve mutually beneficial goals. These partnerships can be used by agencies at all levels of government. Contracts for PPPs offer control over activities to either the public or private organization, depending on which is in the best position to control and achieve the desired results. PPP contracts also provide incentives to the controlling entity to achieve efficiencies and reduce costs in performing activities. In order to meet these performance goals, the controlling entity is given maximum flexibility to develop its work structure and processes to best achieve its objectives.

PPPs are used throughout the federal government in areas such as: technology and pharmaceutical research, depot-level maintenance, transportation projects, military housing and renovation, supply of utilities, and education programs. These partnerships help many government agencies accomplish projects or activities in a faster and more efficient manner.

Legislation and federal acquisition regulations that have impeded the use of public-private partnerships have been changing to allow the federal government easier entrance into partnerships. These changes also make PPPs more attractive for private firms (Rand, 1998). Figure 1 illustrates legislation that has affected PPPs from 1955 to 2000 (Rand, 1998).

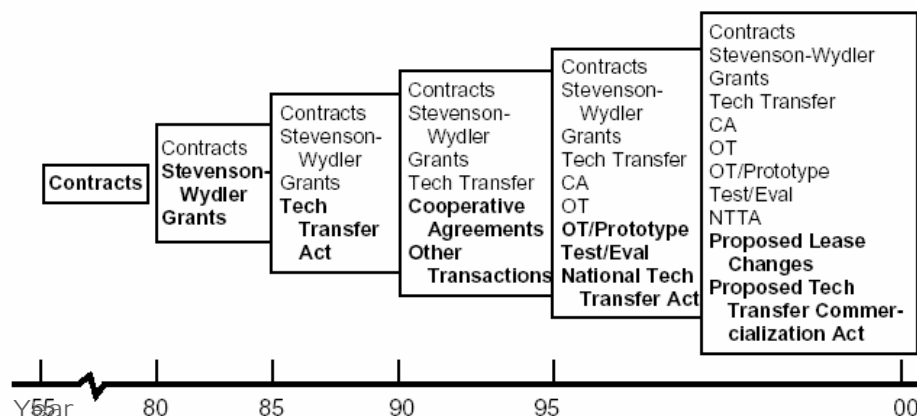


Figure 1. Timeline of Major Legislative Actions Affecting PPPs⁴

Over the past twenty years, legislative actions have introduced Cooperative Research and Development Agreements (CRADAs), Cooperative Agreements (CAs), and Other Transactions (OTs) that have enabled the military to more effectively partner with private entities (Rand, 1998). Figure 1 shows the major legislative changes that have occurred from 1955 until 2000. Many of these changes have reduced barriers that prevented partnerships between the public and private sectors. As legislative barriers are reduced, the federal government is able to establish more partnerships and use innovative and creative solutions to overcome resource constraints. In conducting its research, the RAND Corporation noted that the US Army was able to realize the following benefits by utilizing PPPs (Rand, 1998):

- leverage its assets, reduce capital investments, reduce costs
- decrease outlays to achieve infrastructure, intellectual property, or financial arrangement goals
- increase the value of its property or other assets
- create new capabilities or assets to accomplish its military mission

- influence technology early and get equipment fielded earlier and/or possibly at lower cost
- improve readiness
- receive a stream of revenue to find projects to help the Army accomplish its mission

There are many different types of Public-Private Partnerships. This research focuses on two major types, “fee for service” and ESPCs. One of the major differences between traditional procurement, a “fee for service” contract, and an ESPC is not what goods and services are being used by the federal government, but how the contractor gets paid.

Under a traditional procurement model, a contractor is paid when the goods are delivered. Under an ESPC, the contractor installs energy-saving equipment and gets paid when the installed equipment produces savings. Contractors under a “fee for service” contract get paid once they have performed the work that they were contracted to perform, i.e., mow the lawn, deliver the ammunition to Baghdad, or provide some other type of service to the government.

Another major difference between traditional funding approaches and ESPCs is who bears the costs that result if the service is performed improperly: the taxpayer or the contractor? In traditional funding approaches, the taxpayer assumes the risk, and there is little accountability. What recourse does the taxpayer have if the service provider at Tinker AFB takes 25 more days than required to overhaul a TF-33 engine? Yet, in “fee for service” contracts and ESPCs, the contractor assumes most of the risk. Under both types of contracts, the contractor’s payments are withheld if the services do not meet predetermined performance criteria. The assumption of risk by the contractor is one of the major advantages of using PPP to perform certain functions within the federal government.

Case Study One: Arctic Circle Fiber Optic Program

This section presents an innovative financing arrangement, a “fee for service” contract by Hannon Armstrong, Inc., which provided a vital fiber-optic link near the Arctic Circle. Under a “fee for service” contract, title for the assets does not transfer to the federal government.

Introduction to the Arctic Circle Fiber Optic Scenario

The United States government collects critical environmental and weather information on Svalbard Island, Norway, a unique location on an island above the Arctic Circle. Information gathered at Svalbard was sent via an Intelsat satellite to the US. This communication method was expensive, slow, and unreliable.

The Norwegian Space Agency and Tyco Telecommunications, along with the National Oceanic and Atmospheric Administration (NOAA), the United States Air Force (USAF), and the National Aeronautics and Space Administration (NASA) jointly developed a technical solution to the problem. This consisted of installation of a dual 1300km fiber-optic cable-ring communications network at the Svalbard Satellite Tracking Station (SvalSat), which is located on Plateau Berget, Spitzbergen Island, Svalbard.

However, despite the project’s huge future savings to the US government, appropriated funds were not available for the required \$40 million initial capital investment. The answer was a service contract from the Norwegian Space Agency and an innovative third-party financing arrangement using Hannon Armstrong to finance the \$40 million capital expenditure.

Svalbard’s position at 78 degrees North Latitude allows contact with polar-orbiting satellites during all 14 daily orbits—making SvalSat an ideal location for tracking these satellites that can not be matched by stations in lower latitudes. The installation of the communications cable is a vital component of the satellite facility

SvalSat's infrastructure and is a primary driver for NASA's and NOAA's participation with the Norwegian Space Center (NSC) at SvalSat.

The Project is geographically depicted on the map in Figure 2.



Figure 2. Fiber Optic Scenario Project Map of Cable

Background of the Arctic Circle Fiber Optic Project

NOAA, NASA, and the DoD collect data from satellites in polar orbits that provide weather and environmental information covering all global areas. This data supports such critical and diverse uses as: regional weather forecasting, all aviation forecasts, severe storm and flood reconnaissance and warnings, solar and space environmental forecasts, hydrologic forecasts, seasonal and long-term weather monitoring and forecasting, environmental air-quality monitoring, and defense tactical decision information and weapon systems utilization.

Polar-orbiting satellites orbit the earth from pole to pole. As the Earth rotates, each pass covers a different swath of the terrain below. Typically, these satellites orbit 600 miles above the Earth and carry a wide variety of sensors that provide data

for numerous applications. These are in considerable contrast to the typical communications satellites in geo-stationary orbits that are approximately 22,000 miles above the Earth's surface and orbit at a speed synchronized with the Earth's rotation, thereby staying over one place on the Equator. The polar-orbiting satellites represent the principal means of collecting data over vast areas of the globe. The data for aviation weather, global shipping, disaster prediction, etc., are all of vital interest to the US Government.

US weather, oceanographic, and environmental data have historically been collected by a variety of separate systems and agencies: by NASA for scientific and environmental use, by NOAA for civilian use, and by DoD for military use. In 1994, Congress created the National Polar-orbiting Operational Environmental Satellite System (NPOESS) as the next generation system to monitor global environmental conditions and collect data related to weather, atmosphere, oceans, land, and near-space environment.

In creating NPOESS, Congress recognized that combining the existing polar satellite systems from NASA, NOAA, and the DoD would result in a more cost-effective and a better performing integrated system. The President endorsed this initiative, signing Presidential Decision Directive NSTC-2 (Presidential Decision Directive/NSTC-2, 2006). NPOESS is managed by the Integrated Program Office (IPO), which organizationally resides within the Department of Commerce (DoC). The IPO employs personnel from NOAA, DoD, NASA, and the DoC (NOA, 2006). IPO is housed within, and is administratively part of, NOAA in Silver Spring, Maryland. In August 2002, Northrop Grumman and Raytheon were awarded a \$2.9 billion contract to build and support the first two NPOESS through 2012, with options for an additional four satellites through 2019, for a total of \$4.5 billion.

Figure 3 illustrates how NPOESS is currently organized.

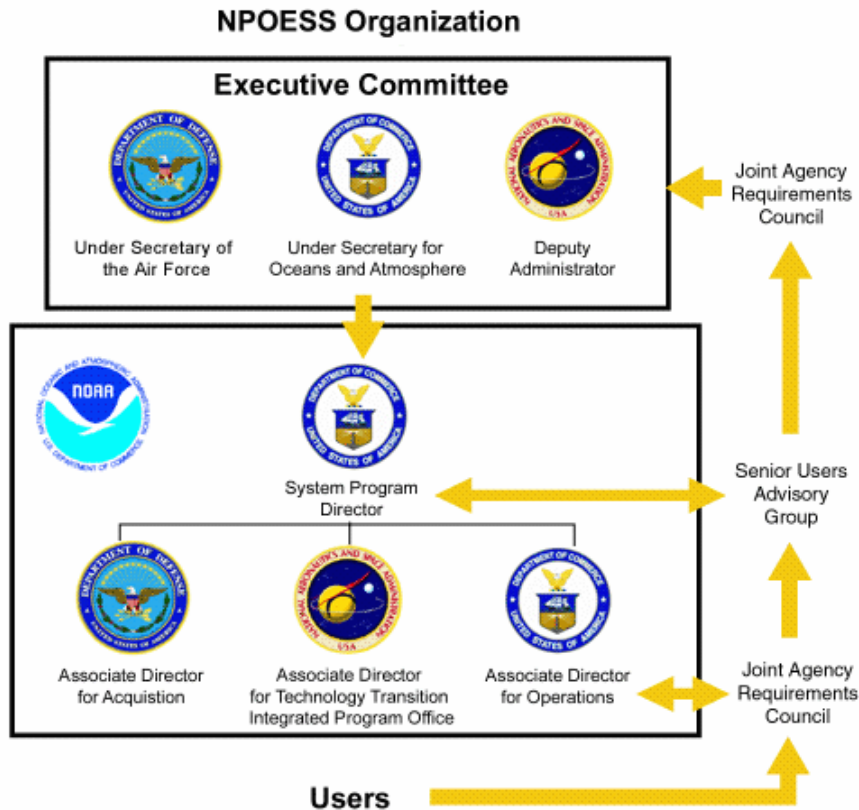


Figure 3. NPOESS Organization from NOAA Satellite and Information Service
 (Source: http://www.ipo.noaa.gov/About/ipo_org.html; accessed Mar 10, 2006)

The Economics of the Arctic Circle Fiber Optic Project

The existing NOAA and DoD satellites that will ultimately be replaced or augmented by NPOESS will increase their use of the SvalSat facility over the next decade. As additional sensors and capabilities are added, there will be a greater need for both command and control, and data transmission. NOAA and the DoD missions require an enduring capability to acquire, store, and disseminate to processing centers, global and regional meteorological, environmental, and associated data at varying refresh rates. These data shall include, but are not limited to, information on imagery, atmospheric profiles of temperature and moisture, and other specialized meteorological, terrestrial, climatic, oceanographic, and solar-geophysical data, as well as a search-and-rescue capability to support world-wide US Government (Military and Civil) operations and high-priority programs.

With the additional requirements of the NPP and NPOESS programs, combined NOAA/NASA telecommunications costs using existing leased satellite capacity for telecommunications transmission would have been approximately \$10 million per year. The installation of a dual fiber-optic ring communications network to SvalSat would offer expected combined savings of \$2.5 million per year over the repayment period, and nearly a \$10 million savings annually by the US Government over the remainder of the 25-year initial period of operations.

Innovative Financing Solution of the Arctic Circle Fiber Optic Project

The contractor installing the fiber-optic network, Tyco Telecommunications (US), Inc. (Tyco Telecom), Princeton, NJ, declined to accept deferred annual payments from the US agencies, said Rolf Skår, Director General of the agency.

“To get Svalbard into the picture, we had to do something,” Skår said. “The challenge was how to finance the project. [...] none of the suppliers was willing to accept deferred payments.” (Ratnam, 2003, November 17)

Tyco Telecom, a world leader in the installation and servicing of state-of-the-art submarine fiber-optic cable systems, won an international tender issued by NSC to supply and install the project. This consisted of a dual fiber-optic cable ring, with each segment connecting the SvalSat station in Longyearbyen, Svalbard, to the Telenor (the main Norwegian telecom utility) system in Halstad on the Northern Cape of Norway, the nearest part of the European mainland. Tyco will be providing terminals and other related equipment to complete the project as part of its scope. Each segment of the ring will run approximately 1400 km (see Figure 2). The dual cable-ring system provides necessary redundancy in the unlikely event one cable requires repair. Capacity of the project will be 20 GB per second over each of the two segments of the line.

The eventual economic solution converted planned operating dollar expenditures into a stream of payments that could support the capital investment required in the “fee for service” or “paid from savings” contract, as depicted in Figure

4. This saved the US government \$140 million over the 20-year contract term, while it improved the system capacity and reliability. Hannon Armstrong structured and funded the transaction (McMahon, D. & Hannon Armstrong, 2004).

Example:

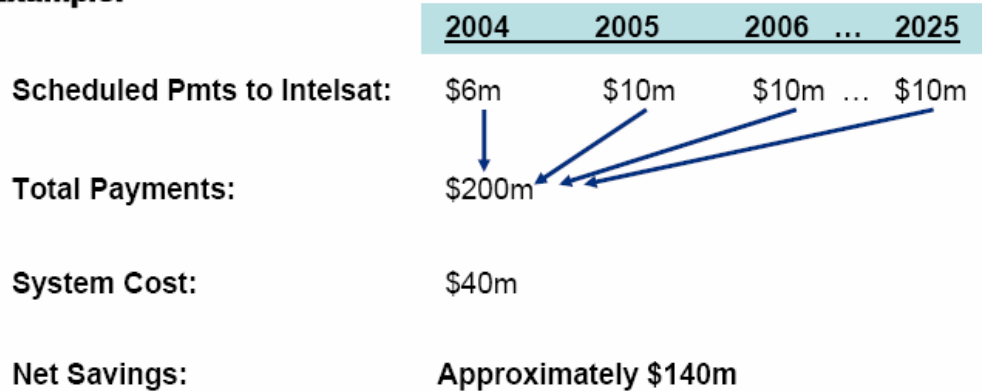


Figure 4. The Economic Solution to Case Study

(Source: From Hannon Armstrong website;
<http://www.hannonarmstrong.com/files/CMANorwaycs.ppt.ppt#261,5,Slide 5>)

The transaction is structured as Hannon Armstrong's purchase of NASA and NOAA receivables from NSC. These receivables arise pursuant to the Intergovernmental Agreement. Later, NOAA and NASA will make their Contract Payments to the Hannon Armstrong Space Centre Funding account according to the Assignment Agreement. The Lender, who provided the initial capital, will receive its debt service payments from this account.

The diagram in Figure 5 depicts the flow of funds in the financing solution that was explained above.

The Financing Solution

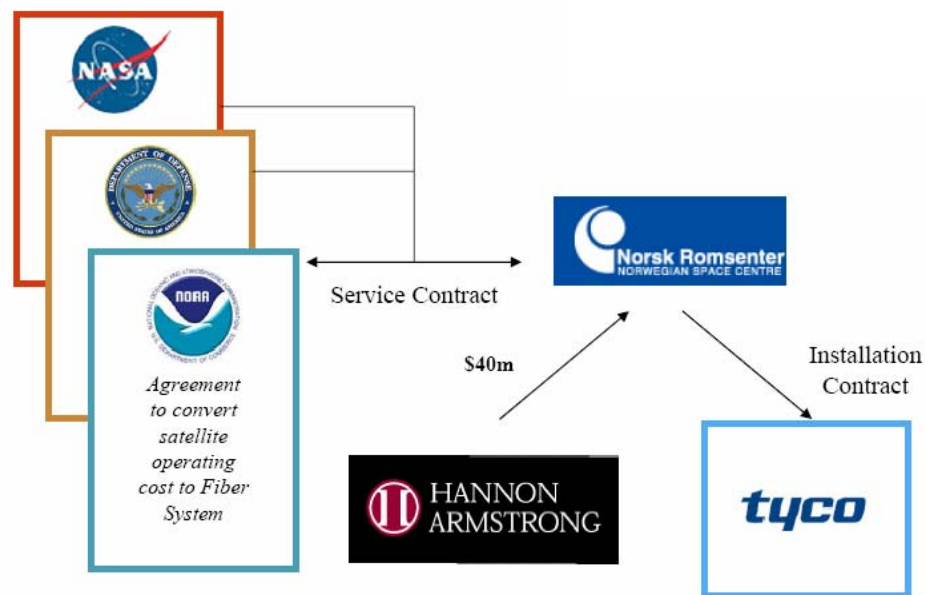


Figure 5. The Financing Solution to Case Study

(Source: From Hannon Armstrong website;

[http://www.hannonarmstrong.com/files/CMANorwaycs.ppt.ppt#262,6,Slide 6\)](http://www.hannonarmstrong.com/files/CMANorwaycs.ppt.ppt#262,6,Slide 6)

Hannon Armstrong raised the up-front capital for the project through private placement. Unlike public issue of stocks and bonds where the federal and state laws mandate extensive public dissemination of information about the project, private placement usually involves raising money from sophisticated financial institutions, such as major banks, pension funds, and large insurance companies (Ratnam, 2003, November 17). Unlike other sectors of the capital markets, investing in federal contract financing requires an understanding of how federal operations differ from commercial operations. Moreover, once investors understand the real, as opposed to perceived, risks of federal contracts, they accept a lower return commensurate with the lower risk. Thus, the cost of capital is lower, as is ultimately the price for the service provided. The \$40 million raised by Hannon Armstrong for this fiber-optic system remained in an escrow account until Tyco met milestones determined by the Norwegian agency. Hannon Armstrong's return on investment is realized when the payments are made over a period of years by NASA and the IPO,

which includes NOAA, the DoD, and the DoC. Total repayments will total about \$50 million over five years.

The cable will cost each agency \$5 million a year for five years. Thereafter, under an agreement with the Norwegian Space Center, the agencies will then have almost free use of it until 2030. The agencies will save about \$1 million a year over the cost of using the relay satellite for five years, and then each will save the whole \$6 million a year for 15 more years (*Hardy, 2004*). For a total of \$50 million investment, \$190 million in future costs will be avoided. This saves around \$140 million for NASA and the OIP. This is supported in the following statement by US General Services (2004):

The financing illustrates how the government can utilize private capital to save the public sector a lot of money while upgrading its service. NASA and NOAA will each realize an immediate \$1 million per year cost savings by switching service to the fiber optic cable, instead of commercial satellite data transmission. After the initial 5-year period, the agencies will no longer owe service payments and will each be able to realize full savings for the next 22 years [...] the advantages for the US government were clear as agencies are able to access a critical service without seeking new Congressional appropriations.

Risks Associated with the Arctic Circle Fiber Optic Project

NOAA and NASA each have the right to terminate for convenience their respective use of the telecommunications services pursuant to the Project Implementation Agreement (PIP)/ Memorandum of Understanding (MOU). In either case, a termination prior to an agency's final payment will require the agency to pay NSC the remaining payments set forth in the PIP. The sum is due three months after the termination date. This termination amount will be sufficient to fully amortize the Hannon Armstrong investment and cover interest for the two intervening months between termination and payment of the termination amount.

Additionally, Article 4 of the Intergovernmental Agreement states that "obligations under this Agreement and any implementing arrangements hereunder shall be subject to the availability of appropriated funds." US Government funding for

this project is appropriated annually by the US Congress. According to the Anti-Deficiency Act, the Executive Department cannot commit to a binding obligation in excess of its funding. Since this project represents a decrease in annual funding requirements compared to a commercial satellite lease and offers significant long-term savings, it is assumed that funding will continue. Nevertheless, the availability of future appropriated funds is an important risk to consider.

Financial Analysis of the Fiber Optic Cable Project

The savings stated above were from publicly available sources. In this section, an independent discounted cash flow analysis concerning the capital investment of the fiber-optic line is presented.

For this analysis, the cost of capital to the government was deemed to be the ten-year Treasury Bill rate, in accordance with OMB Circular A-94, *Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs*. As of April 2006, the rate of a ten-year and thirty-year Treasury Bill was approximately 5 percent.

The government ultimately used a Private-public Partnership to fund the fiber-optic system. The lifecycle costs of the three options available to the government are analyzed over the twenty-year period of the contract: status quo, pay for the fiber-optic line outright or using the financing method described above.

Option 1—Status quo:

If the current location is used, the fiber-optic line is not installed and cost savings are zero. Thus, the government will make payments of ~\$10 million a year for twenty years. The present value of these annual payments equate to a present value of ~\$130.9 million when discounted at 5 percent. Therefore, the net cost of the status quo option is ~\$130.9 million over the twenty years.

Option 2—Pay for the fiber-optic line outright in one single lump-sum payment at the beginning of the contract:

The one time ~\$40 million expenditure would result in Government savings of ~\$130.9 million over twenty years.¹ This option results in a net present value savings of \$90.9 million (\$130.9 million in savings minus the \$40 million investment). Note that savings will continue past twenty years.

Option 3—Public-Private Partnership:

The present value of the five annual \$10 million payments under this option is ~\$45.5 million for the fifteen years after the payment period. The agencies will then have almost free use of the fiber-optic line under an agreement with the NSC. Since the savings will not be realized until after year five, the savings must be discounted back to period one, resulting in a present value of ~\$85.4 million savings. Therefore, this option results in a net present value savings of ~\$39.9 million (\$85.4 million in savings minus the ~\$45.5 million investment discounted over five years) over the twenty-year period analyzed. Note again that savings will continue past twenty years. Figure 6 summarizes the net present values of the three options as Lifecycle Costs (millions). Note that the purchasing and PPP options are actually savings, not costs.

| Options | | (Over Twenty-year contract) | | |
|-------------------------------|--------------|-----------------------------|--------|-----------------|
| | Upfront Uses | Outflow | Inflow | Lifecycle costs |
| 1) Status quo | | 130.9 | | 130.9 |
| 2) Purchase system | 40 | | -130.9 | -90.9 |
| 3) Private-public Partnership | | 45.5 | -85.4 | -39.9 |

Figure 6. Net Present Value Savings over Twenty-year Period (millions) ²

The government's best option is to pay \$40 million upfront. The discounted savings realized by this option is ~\$90.9 million versus a savings of ~\$39.9 million

¹ \$10 million a year * 20 years discounted at 5%, annuity due

using Private-Public financing. Both of the options trump the status quo, which results in the highest lifecycle cost. While purchasing an asset upfront appears advantageous, money from the US Treasury is not free, nor is private-sector capital. The Federal Government operates at a deficit, and the funds must be borrowed to purchase an asset outright. Therefore, the cost of borrowing capital must be considered in making a comparison against the cost of the financing option.

In addition to borrowing costs, the amount of appropriated funds is very limited; not all projects can be funded. This case is more of a question of: should the US government finance the project *or* do without the upgrade and forgo the future saving and increased efficiencies?

What is the opportunity cost of not undertaking this \$40 million project? While quantitative data help support a decision, it is important to look at the qualitative data such as the operational benefits of the project. As mentioned previously, with the installation of a dual fiber ring communications network to SvalSat, transmission speed, bandwidth, and reliability of the system improved significantly. Operational improvements of the new system must be taken into consideration.

Through Executive Order (E.O.) 13123, dated June 8, 1999, the Executive branch strengthened the government's position on private financing already authorized by Congress (Section 403 (b) (4)):

DOE and OMB shall also explore the creation of financing agreements with private-sector suppliers to provide private funding to offset higher up-front costs of efficient products.

The CEO of Hannon Armstrong, Jeffrey Eckel, noted, "By using this unconventional financing approach, Norway and the US government were able to access a critical service without seeking new appropriated dollars from Congress" (Ratnam, 2003, November 17).

² Present Values rounded; calculated with Hewlett Packard 10B financial calculator; may differ slightly from Present Value table calculations.

Without the use of this innovative financing agreement, this necessary link would have been a “non-starter” that would not be in the best interest of the American taxpayers and National Security. Mr. Eckel also said: “it does show how new transactions could be conceived [...] frankly, that’s where the problem is; people don’t know that you can do this kind of stuff [...] it should be very interesting to Congress” (Ratnam, 2003, November 17).

Case Study Two: Adapting Energy Savings Performance Contracts (ESPCs) to Mobile Assets

The second case study examines another Hannon Armstrong financing arrangement, the adaptation of Energy Savings Performance Contracts (ESPCs) to mobile assets. If ESPCs were allowed for mobile assets, significant savings would result—as demonstrated in the B-52H scenario described in this section. In order to understand how the EPSC model can be adapted to a mobile asset, it is important to first understand how ESPCs work. Therefore, the ESPC model will be presented and then applied to the B-52 Bomber scenario.

History of the ESPC Legislation

The Energy Savings Performance Contract (ESPC) was originally authorized in the 1986 amendments to the *National Energy Conservation Policy Act (NECPA)* of 1978 (codified at 42 USC8287). Congress created the ESPC concept as a tool to meet conservation and efficiency goals for federal buildings. These goals were set forth in detail by various Executive Orders and directives requiring federal agencies to use 35 percent less energy by 2010 in comparison to 1985 usage levels (US DOE, 2003). However, Congressional appropriations for the infrastructure improvements to comply with these initiatives were insufficient. As mentioned above, Congress first authorized the use of ESPCs to upgrade federal buildings in the 1986 amendments to NECPA. But the general provisions of NECPA were made more specific and functional by the *Energy Policy Act of 1992 (EPACT)*. Later, in 1998, authority was extended through October 2003. Most recently, the Energy Policy Act of 2005, Section 105, extended the authority for all federal agencies to use ESPCs under Section 801 of NAECA from October 1, 2003, until September 30, 2016. An increased public confidence in ESPCs has resulted in a significant ten-year extension of ESPC authority.

One of the most important documents regarding energy reduction was Executive Order (EO) 13123—*Greening the Government through Efficient Energy*

Management, dated June 8, 1999. Through this EO, the Executive Branch strengthened the government's position on private financing that was already authorized by Congress. The President encouraged private financing and defined requirements for agencies to meet specific energy-reduction goals. Most importantly, he supported the use of ESPCs to achieve them. An excerpt from Section 403 (a) is as follows (Executive order 13123, 1999):

Financial Mechanisms [...] Agencies shall maximize their use of available alternative financing contracting mechanisms, including Energy Savings Performance Contracts and utility energy-efficiency service contract, when lifecycle cost-effective, to reduce energy use and cost in their facilities and operations. Energy Savings Performance Contracts, which are authorized under the National Energy Conservation Policy Act, as modified by the Energy Policy Act of 1992, and utility energy-efficiency services contracts provide significant opportunities for making federal facilities more energy efficient at not net cost to taxpayer.

How ESPCs Work

ESPCs are highly specialized federal contracts that allow the federal government to upgrade obsolete capital assets in the absence of capital appropriations. Energy service companies finance, install, and maintain new energy-efficient equipment (e.g., lighting, boilers, and chillers) in government facilities. ESPCs are similar to "share-in-savings contracts," which enable federal agencies to obtain capital more quickly than through traditional appropriations. But unlike most share-in-savings contracts, ESPC payments are capped in a way that the government realizes excess savings beyond the amount used to amortize the initial capital cost of the upgrade that produces that savings. Thus, the contractor bears all the downside risk of less-than-expected savings, while the federal agency enjoys all the upside reward of better-than-expected savings. Truly, this is the best possible risk allocation for the federal agency and the taxpayer.

While both ESPCs and leases allow the federal government to avoid paying the total cost of an asset up front, an ESPC transfers title to the federal government as soon as the asset is accepted by the government. The familiar defense

acquisition management acronym, Government-Owned and Government-Operated (GOGO) assets apply to ESPCs.

Using an ESPC avoids the myriad issues related to federal leases, such as allocating risk of loss, insurance, restrictions on use, and disposition of the asset at the end of the lease. Therefore, ESPCs are most appropriate for assets that the Federal government intends to keep for the long term. For this reason, ESPCs have been widely used to upgrade assets that are permanently embedded in the infrastructure of federal installations. This is also why ESPCs generally require perhaps the most rigorous lifecycle cost analysis of any type of federal contract.

Cost/Savings to the Government

The Alliance to Save Energy, a non-profit coalition of Energy Service Companies (ESCOs) and other groups, estimates that the federal government wastes \$1 billion each year on its buildings that use energy inefficiently (Alliance to Save Energy, 2005). Before the inception of an ESPC, the federal government used taxpayer dollars to pay for utility bills and operation and maintenance costs for federal buildings, which are often old and energy inefficient.

At initiation of each ESPC, ESCOs recommend potential Energy Conservation Measures (ECMs), install the equipment, and verify that the improvements yield intended results. Financial services firms, such as Hannon Armstrong, raise private capital for the improvements from various investors. Without ESPCs, agencies would have to reassess their budget plans to accommodate investments in ECM and/or Congress would be asked to appropriate funds to finance investments to meet currently required energy-consumption goals (Government Accountability Office, 2006).

During the ESPC, the government pays for upgrades, with interest, out of the savings generated by the upgrades. By law (PL 109-58, 2006), the government pays no more than it would have paid for utilities if it had not implemented the ESPC. After the ESPC expires, the government keeps all of the savings, freeing up even

more taxpayer dollars to be used for other priorities. The chart in Figure 7 graphically illustrates the Agency's cash flows before, during, and after the ESPC.

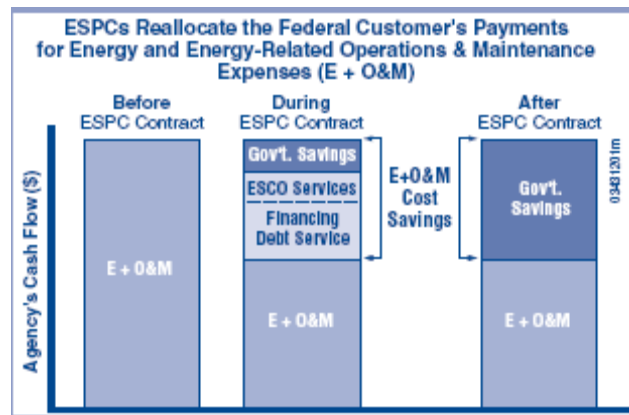


Figure 7. Illustrates Agency's Cash Flows before, during and after ESPCs
(Source: From Federal Energy Management Program; DOE/GO-102003-1744 July 2003)

Risk Exposure in ESPCs

The primary reason for success of ESPCs is that the ESPC contractor, not the government, bears the risk of generating savings to pay for the acquired assets over time. When savings exceed the ESPC payments, the government retains all excess savings (Federal Energy Management Program, 2003). Why would a contractor agree to an ESPC unless it had absolute confidence that savings would result? However, it is also true that ESPCs allow the federal government to retain certain risks when it is logical to do so.

The most common risk retained by the federal government under an ESPC is the utilization rate of an asset. Even the most efficient asset cannot produce savings if it is not used, and it is generally only the federal agency that controls the use of the asset. The federal government often stipulates the utilization rate of an ESPC asset. Such stipulations are also used in cases where actual measurement and verification of savings are too costly or otherwise impractical for the federal agency. Lighting systems in federal office buildings are perhaps the most common example of impractical measurement and verification. It is far more efficient to simply

“stipulate” the utilization rate at, say, eight hours per day than to install data-capture technology at every light switch.

Historical Use of ESPCs

While the DoD alone contracted 60 percent of the projects and 70 percent of the investment dollars (US Department of Energy, 2005), ESPCs have been used in 18 different federal agencies and departments in 46 states. Over 300 ESPC transactions have been executed between the federal government and major US energy service companies such as Honeywell and Johnson Controls. The total value of these private-sector investments exceeds \$1.8 billion (US Department of Energy, 2005). These improvements save 14.4 trillion British Thermal Units (Btu) annually.³ To get a sense of the scope of the Btus saved, you can equate that annual saving to 143,000 households or a city of a half million.⁴ These projects will save the government \$5 billion in energy costs after \$3.5 billion of the savings are used to pay off project investments. Net ESPC savings to the government are \$1.5 billion.⁵

Initially, federal energy management projects were funded primarily through annual appropriations and innovative financing techniques such as ESPCs and Utility Energy Service Contracts (UESCs). However, the role of ESPCs and UESCs has become increasingly more important to the federal government as individual agencies struggle to maintain and improve the energy and water efficiency of their facilities to meet energy reduction, environmental, and energy security goals. This is

³ Determined by applying the FY2000-2003 average of 8000 Btu saved annually per dollar invested to the \$1.8 billion ESPC investment. (ORNL 2005-02583/jcn July 2005) IS THIS SOURCE? NEED MUCH MORE INFO.

⁴ The conversion to households is derived from *EIA Annual Energy Outlook* 2005, Table A4. (ORNL 2005-02583/jcn July 2005).

⁵ Savings total is based on guaranteed savings (2.196 times investment per FY2000-2003 data), plus additional savings not guaranteed (ESCOs generally guarantee a conservative 95% of estimated savings), and 3 years of equipment service life after payments to ESCO end. (ORNL 2005-02583/jcn July 2005).

especially true given the current increase in gas and oil prices and a major reason that use of ESPCs for mobile assets must be considered.

During the past four years, almost 80 percent of federal energy management projects were funded by alternative financing mechanisms. Data reveals that the federal government's use of ESPCs for energy conservation grew dramatically while appropriated funding for energy projects remained relatively constant or decreased. In the past five years, ESPCs accounted for 51 percent of the total federal investment in energy conservation, while appropriations accounted for only 23 percent (Federal Energy Management Advisory Committee, 2004).

The breakdown of federal spending by funding source to meet energy-conservation goals is depicted in Figure 8.

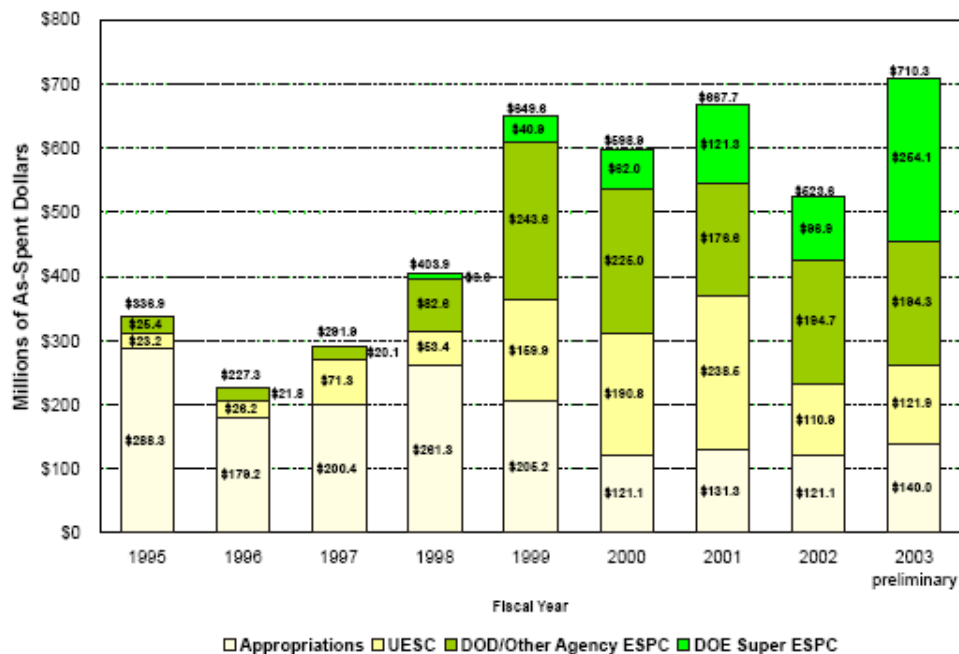


Figure 8. Federal Spending by Funding Source to Meet Conservation Goals, 1999-2003

(Source: Federal Energy Management Advisory Committee. 2004, September 8)

In the decade-long Federal experience with ESPCs, there are no "Terminations for Default" on record. In addition, the small number of "Terminations for Convenience" have been generally precipitated by Federal agencies using end-of-year excess funds to "buying out" well-performing ESPCs.

Note that there have been a handful of "Termination for Convenience" cases where the underlying asset was lost, such as a GSA building located near the World Trade Center that was destroyed on September 11, 2001. This provides a useful example of how an ESPC is an appropriate and robust contracting model for upgrading combat aircraft that could be lost to enemy fire or accident.

CBO and OMB Views of ESPCs

While OMB considers the ESPC program to be "budget neutral" and says it "saves the government money" (Alliance to Save Energy, 2005), the CBO has

switched their position on ESPCs. Initially budget neutral, CBO reversed their policy in 2003 just as Congress was considering ESPC reauthorization and expansion.

CBO reversed over a decade of precedent and scored the ESPC legislation as direct spending,⁶ refusing to consider the savings that offset any government payment, even though payments and savings under an ESPC are a mathematical identity. CBO viewed the savings as “discretionary” spending. This new CBO scoring policy is illogical because no payment is made unless there are savings in an equal or greater amount. But despite the flawed logic, few members of Congress will vote for a measure that appears to be a “budget-buster.” Moreover, CBO was designed to be the honest broker in budget matters, so many members of Congress respect the independent “referee” role of CBO, even when they disagree with the “ref” on a specific call. This is not to say that CBO is never overruled, only that such an overruling is infrequent. When it does occur, it is generally at the specific direction of the House and/or Senate Budget Committee Chairmen, to whom CBO reports. Fortunately, despite the view of the CBO, the Energy Policy Act of 2005 passed. This extended the authority for all federal agencies to use ESPCs under Section 801 of NECPA from October 1, 2003 until September 30, 2016.⁷

Analyzing and understanding how the application of third-party financing to a government project results in cost savings is an important element of applying ESPC to another asset class that has not traditionally been contracted for in this way: mobile assets. The next few sections will outline the B-52 Bomber aircraft re-engining project and how the ESPC model could benefit this effort.

⁶ CBO counts the total obligation to the government when the contract is signed.

⁷ PL 109-58: the passed bill with ESPC reauthorization despite CBO’s adverse scoring of the measure at \$2.9 billion. See, <http://www.cbo.gov/showdoc.cfm?index=6581&sequence=0>

Applying the ESPC model to the B-52H

Introduction to the B-52H Scenario

In 1996, Boeing submitted an unsolicited bid to re-engine the United States Air Force's (AF) aging B-52H fleet. It was rejected by the Air Force because the estimated payback period was 36 years, which was not deemed economically acceptable. In addition, Boeing and the AF listed several reasons why the program could not be justified (US Air Force & the Boeing Company, 2003):

- A constant fuel price calculated at the Defense Energy Support Center's annual rate.
- The AF estimated that the depot costs of maintaining current engines would remain stable and never exceed \$299,000 per year through year 2037.
- Savings were not calculated for reduced refueling that would not be needed.
- Funding did not compete against higher priority programs.
- Premature retirement and reductions in force were considered program risks.

Premature retirement and fleet reductions are legitimate factors that should be considered, but assuming that fuel and maintenance costs would remain stable over 40-years and not allowing for cost savings from reduced refueling needs caused the AF to reject the proposal (US Air Force & the Boeing Company, 2003).

In 2002, the Defense Science Board (DSB) released a report, which supported and recommended the Boeing plan as a way to upgrade the fleet of B-52H's. This report was subsequently updated and re-released in 2004. A list of seven DSB recommendations for re-engining was released (US Air Force & the Boeing Company, 2003):

1. The B-52H is the most versatile and cost effective bomber in the AF fleet.

2. The B-52H is the only platform capable of launching Conventional Air-launched Cruise Missiles (CALCM) in the inventory.
3. Further reduction in the B-52H fleet is not likely.
4. The re-engining program has low technical risk.
5. The plan gives the B-52H fleet greater operational range, reduces fuel burn and tanker demand, and reduced maintenance costs.
6. The program could be used to further the use of Energy Savings Performance Contracts (ESPC) into mobile assets such as weapon systems.
7. The AF task force determined that the benefits of the re-engining program outweighed the cost associated.

The two different views establish the basis for the debate on whether the B-52H fleet should be re-engined, and, if so, how Congress should pay for the program.

The Economic Aspect of the B-52H Re-engining Program

The analysis provided by the Defense Science Board (DSC) task force lists the following cost items and the estimated values to be used in the analysis.

Fuel Cost:

The AF allocates 22,000 flying hours for the B-52H fleet. The current engines use a total of 3,310 gallons of fuel per hour. Through re-engining, the AF team has concluded that the aircraft will use 33 percent less fuel, or a total of 2,218 gallons per flying hour. This can save the AF about 24 million gallons of fuel over the course of a year and approximately 840 million gallons over the remaining 35-year life of the airframe. The task force used DESC's \$1.20-per-gallon figure to conclude the AF could save about \$29 million annually, which translates into about \$1.0 billion over the remaining life of the B-52H fleet. However, the \$1.20 number does not take into account logistical assets needed to move, pump, or refuel from the air (Defense Science Board Task Force, 2004).

The cost for refueling from tanker aircraft is significantly higher due to more of a logistical footprint. At the request of the task force, the price of \$17.50 per gallon

(1999 dollars) of fuel received from tanker aircraft was calculated by the Air Force Cost Analysis Improvement Group (CAIG). The task force determined that, by increasing fuel efficiency, the AF would realize direct monetary savings from reducing the amount of fuel required by the B-52H fleet in flight. This information was not considered when the AF made the decision to forego the Boeing offer (US Air Force & the Boeing Company, 2003).

When this information was placed into a tanker requirements model used by the AF, it was determined that the AF could refuel its current fleet with 55-83 fewer tanker aircraft. The AF would realize some cost savings due to aircraft retirements from inventory or the extra aircraft could be used to support other missions that currently would not have been funded. These savings may indeed be all the more critical since in July 2002, the Air Mobility Command, the major command which controls the AF tanker assets, stated that 500-600 tankers were needed in the fleet to ensure continued operations given realistic scenarios that could face the AF (US Air Force & the Boeing Company, 2003). Keep in mind that savings generated are still savings, even if the savings are immediately spent fulfilling the next highest critical priority.

Engine Depot Overhaul Cost:

The report Boeing offered to the AF in 1996 estimated \$426,000 cost for an engine overhaul. The AF's cost analysis used \$257,000 cost to overhaul a TF33-103 engine. The task force that revisited this information found that in 2002, engine overhauls cost an average of \$539,000. Prices rose to \$710,000 and \$832,617 in 2003 and 2004 respectively. This under-estimation of future engine overhaul cost was yet another incorrect factor that led to the AF rejecting the initial proposal from Boeing (US Air Force & the Boeing Company, 2003).

To forecast the costs of depot overhauls, the DSB developed the chart in Figure 9 to show the costs of depot maintenance on the TF33-103 engines through the remaining life of the B-52H fleet (US Air Force & the Boeing Company, 2003).

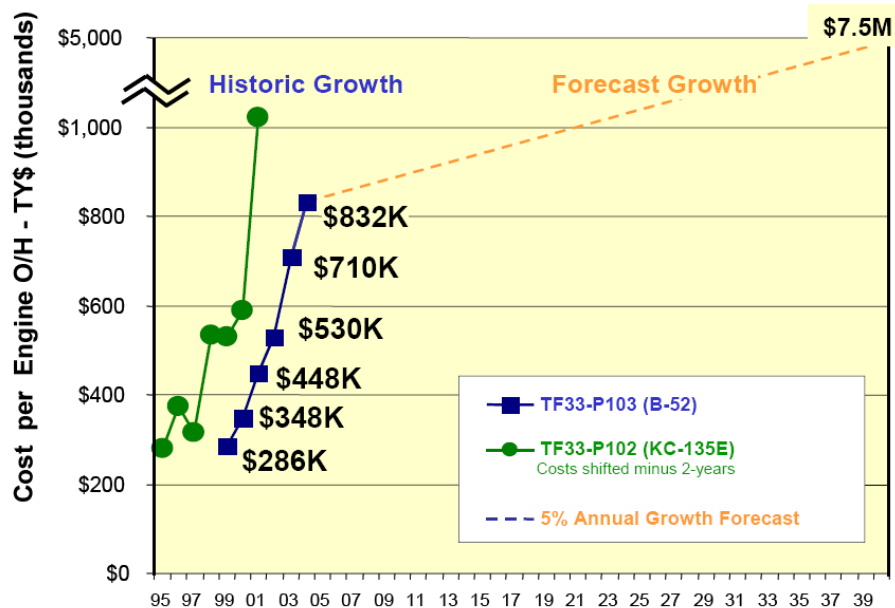


Figure 9. Forecast of the Costs of Depot Overhauls
 (Source: Defense Science Board's proposal to accept the re-engining plan)

The cost of an engine overhaul in the final years of an aircraft's life approaches \$7.5 million (US Air Force & the Boeing Company, 2003).

Boeing has stated that due to recent increased technological advances, a "hang and forget" engine can be used for the B-52H fleet. This means the life of the new engine is longer than the remaining life of the airframe. This significant cost savings was ignored in the 1996 review (US Air Force & the Boeing Company, 2003).

Engine Field Maintenance Cost:

The AF also overhauls about 70 engines per year. Each overhaul costs the AF \$462,400 or about \$32 million total overhaul cost per year. With re-engining, Boeing estimated that the AF could lower its cost to about \$13 million annually, saving approximately \$1 billion over the remaining life of the B-52H fleet (US Air Force & the Boeing Company, 2003).

Annual Air Frame Usage Cost:

In 1996, the AF estimated that a normal B-52H aircraft would fly about 350 hours per year. Since then, the aircraft are flown more than anticipated. During 2003 and 2004, the B-52H flew nearly an extra year per airframe to perform necessary operations. If the fleet is being flown more in the near term, it may prove to be more advantageous to upgrade as soon as possible as older equipment may not be able to stand up to the rigors placed on it (US Air Force & the Boeing Company, 2003).

The Operational Aspect of the B-52H Re-engining Program

If the B-52H re-engining project is approved, the current fleet will have a tremendous increase of operational effectiveness. With greater fuel efficiency, the aircraft will have a much greater range, reach, and loiter capability. The DSB task force defined “range” as the distance an aircraft can fly without being refueled. “Reach” is the sum of the distance an aircraft can fly without refueling and the distance its weaponry will travel. “Loiter” is the time an aircraft can stay over a target to perform a mission without refueling (US Air Force & the Boeing Company, 2003). The current range of a loaded B-52H is 5,088 nautical miles. Under the Boeing plan, this will increase to 7,420 nautical miles. The DSB data in Figure 10 shows that, with the 46 percent increase in range, the re-engined B-52H’s are able to fly from Diego-Garcia Airbase to Kabul and Baghdad without refueling. Also, the re-engined planes will have over four hours loiter time over Kabul and about three hours loiter time over Baghdad. This greatly reduces the number of sorties needed from tanker aircraft and helps to free up ramp space (US Air Force & the Boeing Company, 2003).

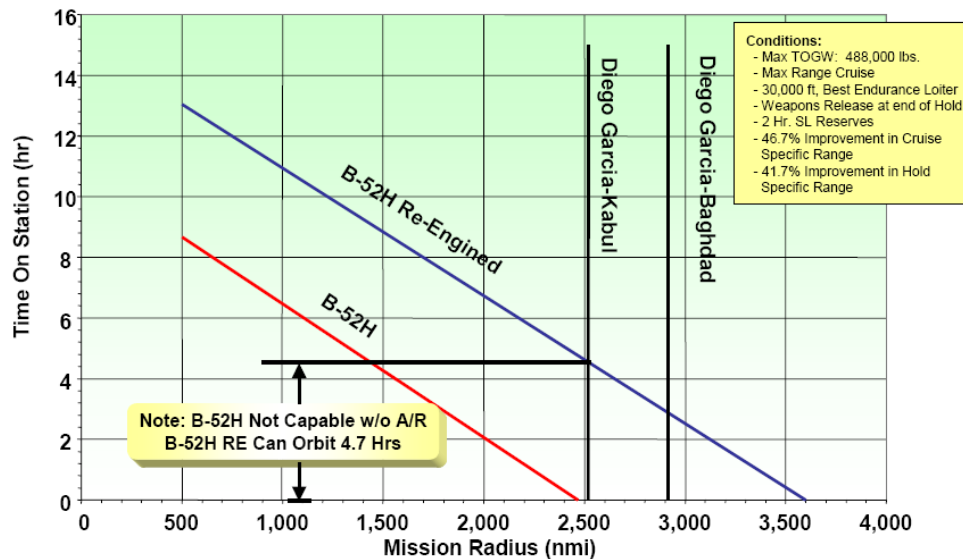


Figure 10. Unrefueled Diego-Garcia to Kabul and Baghdad
(Source: Defense Science Board's proposal to accept the re-engining plan)

With re-engining, a fully equipped B-52H will use runways that are 20 percent shorter. However, a re-engined B-52H will need a runway 175 feet wide as opposed to the current required width of 150 feet. The impact of this width requirement is unknown at this time. However, it is expected to have minimal impact on the operation capacity of the B-52 fleet. In addition, a bomber fleet with an increased range will allow the AF to use less forward operating locations (FOL) and reduce the need for host nation support (US Air Force & the Boeing Company, 2003).

The Environment Aspect of the B-52H Re-engining Program

Environmental factors such as reduction in air and noise pollution would also result from a re-engined B-52H fleet. Currently, B-52H engines do not meet International Civil Aviation Organization (ICAO) standards for emissions, whereas the re-engined planes would meet clean air standards with regard to smoke and fuel venting. The newer engines will reduce noise by about 12 EPNdB, which will bring the B-52H into compliance with Stage III noise standards (US Air Force & the Boeing Company, 2003).

While it is true the re-engined B-52's will use less fuel and cause less noise, the nitrogen oxide (NOx) emissions will nearly double while other pollutants are reduced by 30 percent. The net impact on the environment due to emissions cannot be determined (US Air Force & the Boeing Company, 2003).

Risks Associated with the Re-engining Program

The new engines are 500 to 600 pounds heavier than the existing engines. However, they add about 9,000 pounds of thrust per engine. The total weight these newer engines are expected to add to the airframe is about 5,400 pounds. Also, the wings must be altered. There are ways to handle this impact, such as adding an auto-rudder to the tail of the plane. The cost of this and other modifications to aircraft systems must be included in the evaluation of the re-engining proposal (US Air Force & the Boeing Company, 2003).

The B-52H fleet could be operational through 2040. The average plane logged 14,700 flight hours in 1999. Boeing estimates that a B-52H should fly between 32,500 and 37,500 hours in a lifetime. As seen in Figure 11, most integral parts of the B-52H still have a long life (US Air Force & the Boeing Company, 2003).

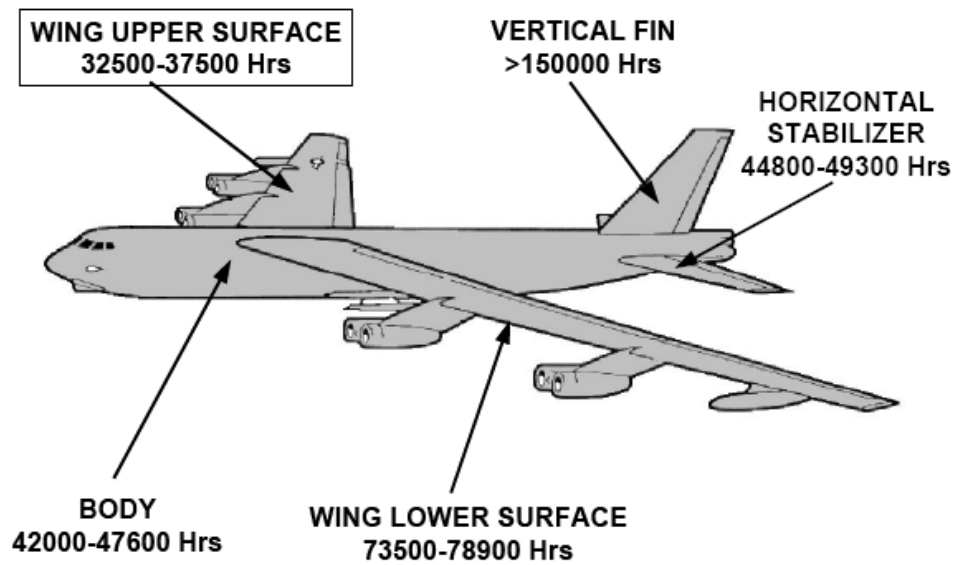


Figure 11. Economic Life of B-52H Structure

The study also assumed that the AF bomber fleet would remain at 208, including 94 B-52Hs. Today, the AF still operates a fleet of 94 B-52Hs,⁸ but there is occasional debate over whether this should be reduced. In March 2006, the Air Force proposed reducing the B-52H fleet to 56, provoking an immediate Congressional reaction.⁹ If the B-52 fleet is reduced, it is important to emphasize that a smaller fleet actually increases that economic benefit of reengining.

⁸ The current fleet of 94 B-52Hs is comprised of two components. The primary component of 76 B-52Hs is the fleet size for which the AF routinely requests funding from Congress. The second component of 18 "attrition reserve" B-52Hs is routinely funded via a Congressional "plus-up" that is above and beyond the funding requested by the Executive Branch. The common belief is that the North Dakota Congressional delegation is the political force behind this annual budget supplement and, to be sure, the importance of Minot Air Force Base to the North Dakota economy is significant, and the basing of 18 B-52Hs at Minot helps ensure this base remains active. Having said that, some believe that the Air Force values the additional 18 aircraft and has come to rely on the Congressional champions' annual efforts to give the Air Force more than DoD or the White House would likely support.

⁹ On March 16, 2006, the Senate passed a provision that effectively blocked any reduction in the size of the B-52 fleet. See Senate Amendment 3139, which amends Senate Concurrent Resolution 83 (Budget Resolution of Fiscal Year 2007). Both measures passed the Senate on March 16, 2006.

In the case of the B-52, the benefits of re-engining are based on total fleet flight hours, while the costs are based on the number of aircraft re-engined. If the number of aircraft in the fleet is reduced, the cost of re-engining the fleet is reduced. As long as the total number of flight hours of the fleet remains a function of military requirements, the only effect of a smaller fleet is that each aircraft will be utilized more, making re-engining more, rather than less, compelling. Even in an extreme case where the fleet might be too small to fulfill the military requirement demands, re-engining those few aircraft would maximize utilization. Finally, it is essential to emphasize that this risk is common to any acquisition method that might be used to re-engine the B-52 fleet, whether financed or not.

Financing Options

Conventional Acquisition:

In a conventional acquisition, the Air Force would use 3010 Procurement Appropriations from Congress to pay for the new engines. Assuming that this model would put re-engined B-52s into service at the same time as other alternatives, this would be the least-cost method as it would reduce payment of interest rates of leases or other financing methods to the lower US Treasury interest rate. The AF would purchase the engines outright, and risk of future non-performance would, in all probability, be divided between the contractor and the AF under warranty terms commonly used in other conventional acquisitions. A purchase of this size would most likely mean that Congress would increase the size of the national debt. The resulting increase in interest payments on national debt offsets the cost savings associated with this option.

Lease:

Leases can offer a variety of benefits to lessees; however, many of these are not applicable to the federal government. The government is not able to take advantage of the tax breaks that are associated with leasing, nor does it benefit from a reduced near-term money flow because the federal government theoretically has access to the money it needs (US Air Force & the Boeing Company, 2003). The

lessor is also not able to take advantage of tax breaks and pass on savings to the government in the form of lower lease payments.

Hourly Rate:

The Navy uses this method of contracting for buying engine maintenance, and commercial airlines routinely pay for maintenance and engine usage under a single “Power by the Hour” contract. Nevertheless, a pure commercial-style “Power by the Hour” is neither currently in use nor has it been used by the military in the past (US Air Force & the Boeing Company, 2003).

ESPC:

Because ESPCs are not dependent on Congressional budget cycles for capital appropriations, upgraded assets are fielded much faster under ESPCs. The savings harvested in those years would otherwise be lost forever and represent a significant offset to the higher interest rate of ESPC as compared to the US Treasury borrowing rate (US Air Force & the Boeing Company, 2003). Another unique aspect of ESPCs is that the risk of asset non-performance is shifted to the contractor for the entire contract period (up to 25 years), which is not the case in the standard warranty used in conventional acquisitions. In such warranties, both the time in which the contractor assumes risk of non-performance and the scope of performance covered is so limited that there is essentially no comparison with the performance guarantee of an ESPC.

How Can ESPCs be Used to Re-engine the B-52H Fleet?

ESPCs have not been used to finance mobile assets in the past because the law that created ESPCs limits their use to facilities. Nevertheless, the Defense Science Board, the Air Force, and Boeing (the original manufacturer of the B-52) have studied re-engining the B-52 fleet using the ESPC model. All studies found that B-52 re-engining under an ESPC was a compelling alternative. Under this scenario, a private financing firm pays for the engines (including any required non-recurring engineering and installation) up front and turns them over to the AF in

exchange for payments over time. These payments are made from savings realized by the AF in reduced fuel and maintenance costs. After the term of the contract ends, all subsequent savings are retained by the AF—whether or not the savings produced during the contract term were sufficient to pay off the cost of re-engining. Again, the contractor guarantees the savings, so if the savings fail to materialize, the government is not liable for payments to the contractor. This puts the pressure squarely on the contractor to perform up to its guarantee (US Air Force & the Boeing Company, 2003).

While Executive Order 13123 could be interpreted to encourage application of ESPCs to mobile assets, this interpretation is generally considered to be inconsistent with the ESPC statutory provisions. Since an Executive Order cannot change a statute, Congressional action would be needed before ESPCs could be used to upgrade mobile assets.

A second aspect that deserves mention is that measuring savings in traditional ESPCs is relatively simple, because most military facilities using ESPCs have a single budget account from which all energy and maintenance expenses are drawn. Thus, if an ESPC produces energy and maintenance savings, it is a simple matter to pay the ESPC payment out of that same single account. But a mobile ESPC upgrade like B-52 re-engining will generate savings in multiple budget accounts. For example, fuel is saved not only through reduced consumption in the new engines of the B-52, but there is also fuel saved through reduced demand for tanker aircraft to carry fuel to the B-52s for mid-air refueling.

Congress has made clear that any upgrade's cost savings analysis (regardless of how that upgrade is acquired) must fully consider the cost of delivering fuel (P.L. 107-107). Thus, the B-52 fuel and maintenance savings would be supplemented by the tanker aircraft fuel and maintenance savings, a completely different budget account. This is even more administratively challenging since tanker aircraft are in such high demand that it is almost certain that tanker resources freed up by less B-52 demand would be immediately re-directed to other priorities.

In other words, the savings generated by B-52 re-engining would be immediately spent elsewhere. Inconvenient though this accounting may be, it is required by law—whether conventional acquisition methods or another alternative is used. Moreover, a strong reminder of priorities is called for at this point: If re-engining the B-52 fleet provides better warfighting capability while also providing better taxpayer value, the accounting system needs to conform to warfighter and taxpayer interests, not the other way around.

There are also some other issues associated with the issuance of an ESPC for use on a mobile asset. Because the engines would be owned by the government, no provisions must be made for insurance, as would be the case if leased or procured under a “Power by the Hour” contract. However, the question remains: what happens if a re-engined aircraft is destroyed? Here the experience of the GSA building (that was upgraded under a traditional ESPC and destroyed on September 11, 2001) is relevant. The government could simply continue to make payments as if the assets were not destroyed, or it could pay a termination liability lump-sum payment to close out the matter. In the case of this GSA building, the government continued making payments for about six months and then terminated the contract for convenience, paying a lump-sum amount to the contractor in accordance with a termination liability schedule incorporated into the original contract.

A mobile ESPC would actually offer additional flexibility, since unlike buildings, mobile assets can often “take up the slack” of a lost asset. Thus, the total flight hours of a fleet of aircraft can often be redistributed among the remaining aircraft if one is lost. As mentioned above, savings are generated by total utilization, which is a function of the total fleet flight hours consumed. Thus, real savings actually would not be reduced by a marginal decrease in aircraft, but only by a decrease in total fleet flight hours.

Clearly, the government seeks commercial off-the-shelf (COTS) engines for use on a military aircraft. These engines have not been designed to military

specifications and would need to be “hardened” to military specifications—at least to the point that the 1950’s TF-33 engines were “hardened.” The contractor will assume this risk, since ESPCs provide no means of shifting this risk or cost to the government. Fortunately, the major commercial aircraft engine original equipment manufacturers (OEMs) are also the major OEMs of military engines for the DoD. Therefore, issues of converting COTS engines for use on B-52s is well within the expertise of these OEMs and is probably a risk that the government should insist be borne by the contractor, even if re-engining occurred under a conventional acquisition. In any case, the issue is common to all potential methods to fund the re-engining program.

Should ESPCs be Used on the B-52H?

The B-52H fleet is in need of engine upgrades. Many of the planes have the original engines from the 1950’s that are still functional but grossly inefficient when compared to the technology available in modern engines. While there are several methods of financing that could be appropriate for this transaction, the one method that stands out as being both feasible and economical is the ESPC method.

If an ESPC is used for the purchase of new engines for the B-52H fleet, the engines should be available in the short term without a huge outlay of funding from the Congress. This will allow the AF to strengthen its forces for current, as well as future, threats. While the method would be slightly more costly than an outright purchase, the shortened delivery time is a huge benefit, both in terms of capturing early economic savings and of providing warfighters increased combat capability sooner.

The DSB task force conducted a net present value (NPV) analysis concerning the B-52H re-engining program and reported favorable results supporting the program. They used the following assumptions through years 2004-2037 (US Air Force & the Boeing Company, 2003):

- 2004 depot engine price of \$832,617

- Depot price growth rate of 5%
- OMB inflation index of 1.9%
- FY96 EMD and production costs of \$3.2B
- 30 year OMB nominal discount rate of 5.5%.

The chart in Figure 12 shows the results of the NPV calculation following OMB guidelines:

| | Current Outlay | Outlay After Re-engining | Outlay Reduction |
|--------------------------|----------------|--------------------------|------------------|
| Fuel Purchase | \$1,774M | \$1,346M | \$429M |
| Depot Purchase | \$3,136M | \$394M | \$2,743M |
| Field Maintenance | \$657M | \$369M | \$288M |
| Total | \$5,568M | \$2,108M | \$3,459M |
| Program Cost | | | \$3,195M |
| Net Present Value | | | \$264M |

Figure 12. Estimated Total Lifetime Change in Direct O&M Outlays with Re-engining in Then-year Dollars (Millions)
(Source: DSB task force)

The program will have a positive NPV at the 5.5% discount rate. This is derived from calculating the difference in cash flows from the current outlay and outlays after re-engining. The cash flows include costs of future year's use of fuel, depot maintenance, and field maintenance. The positive NPV shows that the program would be economically beneficial to the AF to re-engine the planes. While it is also true that further retirement of B-52H's is a major risk factor, this should further persuade the AF to upgrade their fleet. With 94 aircraft in the current B-52H inventory shrinking in the foreseeable future, these aircraft should be more reliable as the total fleet flight hours will not likely change significantly in the near term. These aging aircraft have a chance to maintain a higher operational availability rate if more modern, technologically advanced engines are in place.

The B-52H has been one of the most versatile and battle-tested aircraft of all time. Flying since the 1950's, current plans call for flying them until at least 2038. With more modern engines, the B-52H fleet will have less fuel burn, greater thrust, and more operational reliability. The ESPC financing method provides great benefits to the AF. It's a win-win situation. The AF gets engines it needs now, and pays for them over time through cost savings accumulated through increased efficiencies over the older engines. While this method has never been used on a mobile platform, it is a method that holds much promise. It has substantial merit and should be given full consideration as the preferred method to upgrade the B-52H engines for now and for the future.

Application of ESPC and Mobile Assets

As was discussed above, historically, ESPCs have been used to reduce the energy consumption of federal facilities. From 1999 to 2003, 254 ESPCs were awarded to modernize government facilities (GAO, 2005). Current Congressional legislation limits the use of ESPCs to publicly owned buildings with no provisions given to mobile assets. A recent report by the Federal Energy Management Advisory Committee (FEMAC) urges Congress to adopt pilot programs or grant temporary authority to test the use of ESPCs to reduce energy costs with mobile assets (Federal Energy Management Advisory Committee, 2004). Several attempts to include legislation to authorize the use of ESPCs for mobile assets have failed. In renewing the expired ESPC authority, Congress merely amended expired legislation by extending the program to 2016. With higher fuel costs and a large portion of the federal government's energy consumption attributed to operating mobile assets, Energy Savings Contracts would be a cost-effective solution.

Legislative Changes

Current legislation governing Energy Savings Contracts would have to be amended in order for federal agencies to pursue external funding sources for modernization of mobile assets. In 2003, a bill was proposed (H.R. 3339 National Defense Savings Act of 2003) giving the DoD more flexibility in pursuing energy

savings. This bill would have allowed the DoD to initiate ten pilot programs to determine the feasibility of applying ESPC to mobile assets. In the two years since this legislation was introduced, Congress has not passed the law. Support for applying ESPCs is not only lacking in the Congress, but in OMB as well. In a statement identifying concerns regarding a legislative proposal to include ESPC use for mobile assets, OMB stated (OMB, 2004):

The Administration would object to the movement of the Energy Savings Performance Contracts (ESPCs) authority from DoE to DoD. In addition, we would oppose the expansion of ESPC authorities to non-building applications since it is inconsistent with federal fiscal and procurement policies. The Administration supports immediate extension of current ESPC authority for all agencies.

Beyond just legislation, federal fiscal and procurement policies will also need to be amended to accommodate mobile assets. Though the opposition seems insurmountable, the President's State of the Union address in 2006 directing the country to reduce our reliance on foreign energy may be enough to make ESPC use for mobile assets a reality.

Arguments against the Use of ESPC for Mobile Assets

Opponents of using Energy Savings Contracts for mobile assets argue that the process side-steps congressional authority and the appropriations process. The opponents also contend that no entity can borrow cheaper than the federal government, and using corporate financing is a waste of taxpayer's dollars because it lines the pockets of "money hungry" corporations. However, little attention is paid to the fact that, with ever-constraining budgets, the likelihood of federal agencies receiving sufficient funds to upgrade mobile assets is slim to none. While maintaining the status quo retains Congressional power and oversight, millions of dollars in taxpayer savings through reduced energy consumption are lost.

Proponents' Argument for the Use of ESPCs for Mobile Assets

Supporters of using Energy Savings Contracts with mobile assets contend that the energy savings from upgrades would be real, and that it costs more to do

nothing given the inefficiencies of many platforms being used today. Proponents also contend that the current Congressional Budget Office method for scoring ESPCs does not accurately represent the savings that would be realized through ESPCs. Therefore, they assert the scoring by CBO needs to be revised.

The cost savings are only part of the proponent's argument. Proponents also argue that ESPCs will modernize old, obsolete components of currently used platforms. The process to re-engine a B-52H would not only make the aircraft more energy efficient, but would provide for a better platform and create jobs in the process. A January 2001 Defense Science Board study examined modernizing sixteen DoD weapon systems platforms to achieve energy savings (Defense Science Board Task Force on Improving Fuel Efficiency of Weapons Platforms, 2001). The DSB study concluded that modernization of legacy systems would provide increased operational performance, reduce the logistics tail, decrease Green House gas emissions, and offer a significant return on investment to the DoD (Defense Science Board Task Force on Improving Fuel Efficiency of Weapons Platforms, 2001).

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Conclusion

This research has described the various different perspectives on the federal government's historical use of public-private partnerships. Clearly, PPPs have been very effective in providing applications of innovative financing arrangements by Hannon Armstrong, LLC. Hannon Armstrong's "fee for service contract" solution to a lack of appropriated funds for a needed fiber-optic link near the Arctic Circle saved the government \$140 million. Applying Energy Savings Performance Contracts to mobile assets could further reduce the energy consumption of the Department of Defense and save taxpayers millions of dollars. Few argue over the impact ESPCs have had in generating energy savings in fixed assets. Ideally, the federal government would use appropriated dollars to fund energy-saving upgrades to all assets. However, the appropriations process is slow, time consuming, and federal funds are often not available or are prioritized to other National Security projects. Innovative methods, such as that demonstrated by Hannon Armstrong's financing of the fiber-optic cable project, should be applied to mobile assets, such as the re-engining program for the B-52H fleet, so that these non-starter projects will become a reality and the cost savings can be realized.

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List of References

- Alliance to Save Energy. (2005, May). *Fact sheet*. Retrieved February 2, 2006, from http://www.ase.org/uploaded_files/policy/ESPC-NDESA%20Fact%20Sheet.pdf
- Congressional Budget Office. (2005, June). *Third-party financing of federal projects*. Retrieved March 2, 2006, from http://www.cbo.gov/ftpdocs/63xx/doc6399/06-01-thirdpartyfinancing_brief.pdf
- Defense Science Board Task Force on Improving Fuel Efficiency of Weapons Platforms. (2001, January). *More capable warfighting through reduced fuel burden*. Retrieved March 2, 2006, from <http://www.acq.osd.mil/dsb/reports/fuel.pdf>
- Defense Science Board Task Force. (2004). *B-52H re-engining*. Retrieved March 4, 2006, from http://www.acq.osd.mil/dsb/reports/2004-06-b52h_re-engining.pdf
- Executive Order 13123. (1999, June 8). Greening the government through energy efficient management. Section 403 (b) (4). Retrieved March 6, 2006, from <http://www.ofee.gov/eo/eo13123.pdf>
- EIA. EIA Annual Energy Outlook 2005, Table A4. ORNL 2005-02583/jcn July 2005
- Energy Policy Act of 1992 (EPACT) summary*. Retrieved March 1, 2006, from http://www.csc.noaa.gov/cmfp/reference/Energy_Policy_Act_1992.htm
- Energy Policy Act of 2005*. Section 105.
- Federal Energy Management Advisory Committee. (2004, September 8). *Energy savings performance contracts (ESPC): Report on ESPC authority*. Retrieved March 4, 2006, from http://www.eere.energy.gov/femp/pdfs/femac_espc_report.pdf
- Federal Energy Management Advisory Committee. (2005, May). *Report on Federal ESPC management, volume II*. Retrieved March 4, 2006, from http://www.eere.energy.gov/femp/pdfs/femac_espc_report2.pdf
- Federal Energy Management Program, 2003.
- Government Accountability Office. (2003, August). *Budget issues: Alternative approaches to finance federal capital*. Retrieved February 2, 2006, from <http://www.gao.gov/new.items/d031011.pdf>
- Government Accountability Office. (2005, June). *Energy savings: Performance contracts offer benefits, but vigilance is needed to protect government*

interests. Retrieved February 10, 2006, from
<http://www.gao.gov/new.items/d031011.pdf>

General Accountability Office. (2004, December). *Capital financing: Partnerships and energy savings performance contracts raise budgeting and monitoring concerns*. Retrieved February 2, 2006, from
<http://www.gao.gov/new.items/d0555.pdf>

Hardy, M. (2004, January). Listening to the Arctic skies—NASA, NOAA use Norwegian facility to gather weather and climate data from satellites. *Federal Computer Week*. Retrieved January 8, 2006 from
<http://www.hannonarmstrong.com/files/media-coverage-012604.pdf>

Figure 3. NPOESS Organization from NOAA Satellite and Information Service
(Source: http://www.ipo.noaa.gov/About/ipo_org.html; accessed Mar 10, 2006)

Figure 4. The Economic Solution to Case Study
(Source: From Hannon Armstrong website;
<http://www.hannonarmstrong.com/files/CMANorwaycs.ppt.ppt#261,5,Slide 5, #262, 6, Slide 6>)

(H.R. 3339 National Defense Savings Act of 2003)

McMahon, D. & Hannon Armstrong. (2004, October). Innovative funding; Government agencies: Meeting the challenge using innovative funding strategies. *US General Services Administration—Office of Citizen Services and Communications Newsletter*, (15), 16. Retrieved January 6, 2006, from
<http://www.gsa.gov/intergov>

Martin, M. (2006, March). Lawmakers slam B-52 retirement plan. *insidedefense.com*
NAECA, Section 801.

National Energy Conservation Policy Act (NECPA) of 1978 (codified at 42 USC8287)

Office of Management and Budget. (2004, May 19). Statement of administration policy: S. 2400 National Defense Authorization Act for fiscal year 2005. Retrieved March 2, 2006, from
<http://www.whitehouse.gov/omb/legislative/sap/108-2/s2400sap-s.pdf>

Palmer, K. (2005, January). *Performance-based energy savings contracts may cost government*. Govexec.com Daily Briefing. Retrieved January 23, 2006, from
<http://www.govexec.com/dailyfed/0105/011905k1.htm>

Presidential Decision Directive/NSTC-2. Retrieved March 8, 2006, from
<http://www.ipo.noaa.gov/About/NSTC-2.html>

Public Law 107-107.

- Public Law 109-58. Retrieved February 28, 2006, from <http://thomas.loc.gov/bss/d109/d109laws.html>
- PL 109-58: the passed bill with ESPC reauthorization despite CBO's adverse scoring of the measure at \$2.9 billion. See, <http://www.cbo.gov/showdoc.cfm?index=6581&sequence=0>
- RAND Corporation. (1998). Use of Public-private partnerships to meet future Army needs. Retrieved March 2, 2006, from http://www.rand.org/pubs/monograph_reports/MR997/
- Ratnam, G. (2003, November 17). Finding savings up front: Private investors finance fiber-optic link near Arctic Circle. *Defense News*, 18(43). Retrieved January 8, 2006, from <http://www.hannonarmstrong.com/files/media-coverage-111703.pdf>
- Senate Amendment 3139, which amends Senate Concurrent Resolution 83 (Budget Resolution of Fiscal Year 2007)
- US Air Force & the Boeing Company. (2003). *B-52H re-engine study: Summary of findings*. Oklahoma: Tinker AFB, 2-1.
- US Department of Energy. (2005, December). *Energy efficiency and renewable energy*. Retrieved March 4, 2006, from <http://www.eere.energy.gov/femp/pdfs/34312.pdf>
- US Department of Energy. (2004, July). *Super energy savings: Performance contracts*. OE/GO-102003-1744. Retrieved March 4, 2006, from <http://www.eere.energy.gov/femp/pdfs/34312.pdf>
- Wikipedia*, the free encyclopedia; Retrieved from http://en.wikipedia.org/wiki/Time_value_of_money

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